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Fryer's Pneumatic Pump.

The inventor of this pump has labored years to overcome the difficulties attending the construction of a perfect apparatus for the compression of air or gases, and having at last succeeded, now places before the public a pneumatic pump, with which air or gas can be compressed to any degree, without heating the metal, or causing unusual wear and friction to the working parts. This is effected by submerging the piston and other parts of the pump in water or other liquid, which prevents the air or gas from coming in contact with them, which will be seen by reference to the illustration.

B is the main pumping cylinder; F F are upright conical chambers, connecting with, and opening from the horizontal cylinder, B, at the base of which the inlet valves, E E are placed in small water cells. The chambers K K, connect with the chambers F F, and contain the valve seats J J, with openings at H H, leading to the reservoir I; G G are the outlet valves, placed low enough, so that when closed the liquid covers and seals them; I is a reservoir to receive the air or gases being pumped, and also the liquid which is necessarily ejected from the chambers F F, at the end of each stroke. Connected with the reservoir I, by means of pipe M s the regulator, a metal circular cylinder (inside of which is the oscillating valve N) with ports at M to connect with reservoir I and at pipes P P, to connect with the chambers F F; also having ports opening inward at *a* and *o* to the valve N.

The operation is as follows: As the piston C moves in the direction indicated by the arrow, the liquid is forced up in the upright chamber F, as shown in figure 2, expelling all of its gaseous contents through valve J and pipe H to the reservoir I, and from thence by means of pipes to any point desired. At the same time the liquid recedes from the upright chamber F, creating a vacuum, which is supplied by the air or gas passing through the inlet valve E, filling the chamber. When the piston has travelled almost the extent of its stroke, the cross head, by a mechanical arrangement, shown in figure 1, moves the working part of the regulator, and delivers alternately to the chambers, F F, a supply of water, equal in quantity to the amount ejected into the reservoir I, thus keeping a full supply, so that the entire body of air or gas is forced from those chambers at every revolution. In the reverse movement of the piston the operation is, of course, the same; the valves being raised by one movement of the piston, and closed during the other.

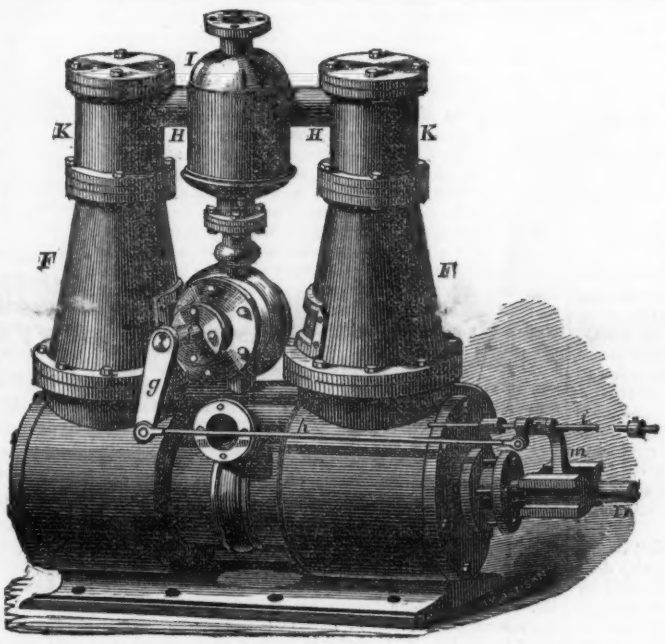


Fig. 1.

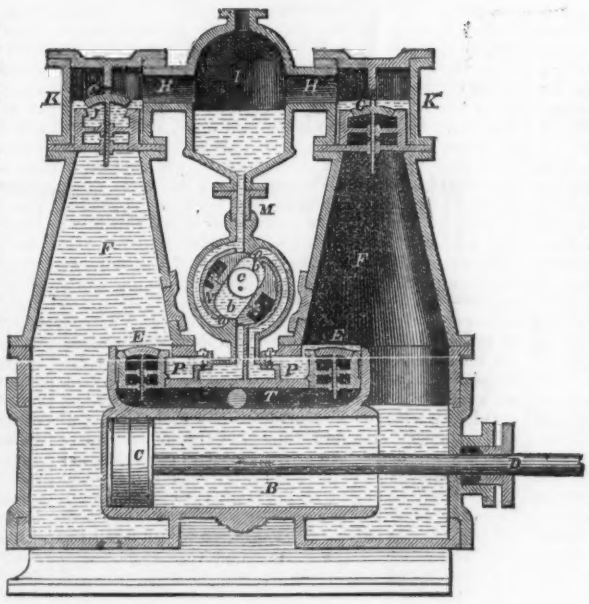


Fig. 2.

This pump is specially designed for mining and tunneling, submarine drilling, gas works, oil wells, ærated bread bakeries, and all places where compressed air or gas is used; and as a vacuum pump for steam engines (especially for propellers), sugar houses, oil refineries, ice factories, milk condensing establishments, and all other places where vacuums are required, the inventor claims it to be the best now in use.

One of these pumps is used at the Oxygen Gas Works, on Forty-first street, near the Eleventh avenue, in this city, where a few days since, at a public exhibition, a pressure of 220 lbs. to the inch was obtained in one minute.

Persons desirous of obtaining further information, or wishing to see the operation of the pump, can do so by calling on Mr. R. M. Fryer, at No. 266 Broadway, N. Y.

Telegraph Enterprise.

Another great European telegraph project is on foot. A company just formed in London has purchased with concessional rights, the following cables, namely: 1st, Denmark to England, from Sondervig to Newbiggin, actual distance 334 miles; 2d, Denmark to Norway, from Hirtshalts to Arendal, actual distance, 60 miles; 3rd, Denmark to Russia, from Moen to Bornholm, and Bornholm to Libau, actual distance, 304 miles; 4th, Norway to Scotland, from Egersund to Peterhead, actual distance, 270 miles; 5th, Sweden to Russia, from Grislehamn to Nystad, actual distance, 96 miles. Of these, the three first are already laid, and have been for some time working; the fourth is shipped on board ready for laying; and the arrangements for the fifth are in course of completion, and both the latter are to be laid at the risk and cost of the old companies. The new company undertakes the working, and will be entitled to the receipts from the 1st of June. The cost of purchase was $2,500,000. The ultimate intention of the company is a connection with North-America *via* the Russian dominions.

Professor J. Ville finds that the waters of certain lakes in Tuscany contain a large quantity of sulphate of ammonia.

Dr. Letheby, on the Methods of Water Analysis and on Sewage Contamination.

A few weeks ago Dr. Letheby read a very important paper to the Metropolitan Association of Medical Officers, of Health, entitled "on the Methods of Estimating Nitrogenous Matters in Potable Waters, and on the Value of Expression 'Previous Sewage Contamination,' as used by the Registrar-General in his Monthly Reports of the Metropolitan Waters." The discussion which followed it was very animated, and was so long that an adjournment for a fortnight was found necessary. In this interesting paper, Dr. Letheby attacked with great warmth the methods of analysis employed by Dr. Frankland, the deductions which the latter chemist thinks himself justified in making from the results of his analysis, and in particular the well-known calculation of "previous sewage contamination" from the nitrogen found as nitrates, nitrites, and ammonia found in the water. He describes the methods in which he himself places reliance—methods which need not be recapitulated here because they are familiar to almost all chemists—and in contrast with them recited a formidable list of the difficulties and errors to which, he asserted, Frankland and Armstrong's methods were liable. This part of the subject, important though it be to chemists, we do not propose to discuss in any detail at the present time, reserving it, if need be, for a separate consideration hereafter. The combustion process, by which Dr. Frankland estimates the organic carbon and nitrogen of a water, is, to judge from the trial experiments, very greatly more accurate than any that has hitherto been suggested for the determination of organic matter. Both the absolute and percentage errors observed in the trial experiments were, indeed marvellously small, considering the extraordinary difficulties to be encountered. Dr. Letheby appears to rely mainly upon the permanganate test, and calculates the amount of organic matter in the water by multiplying the oxygen-indication by eight. This calculation is founded on a comparison between the indication of the test and those of the old incineration method; but as the latter has long been known to be worthless, and as Dr. Letheby himself has abandoned its use, it is difficult to see how the calculation can give even an approximation to correctness. Every one of our readers is, moreover, aware that the oxidising power of the permanganate varies extremely in different cases; that of nine kinds of organic matter examined by Frankland and Armstrong, one—viz., oxalic acid—was completely oxidised by it, even in six hours; that urea, hippuric acid, and creatin were scarcely oxidised at all, while the mineral, sodic nitrite, was oxidised instantaneously.

These considerations are however, somewhat irrelevant upon the present occasion, for Dr. Letherby does not seriously impugn the accuracy of the method by which Frankland and Armstrong effected the determination of the nitrogen present as nitrates and nitrites, and agrees with the latter chemists in employing the Nessler test for the determination of ammonia. It is from these compounds that the previous sewage contamination is calculated, and it is to this calculation that the criticism of Dr. Letheby is mainly directed. The ammonia present in portable waters is generally a small quantity, and we may therefore assume, for the purpose of the present discuesion, that the previous sewage contamination is entirely deduced from the nitrates and nitrites of the water. Dr. Letheby does indeed, impugn the accuracy of the correction made by Dr. Frankland for the nitrogen introduced by rain; but this makes little real difference, for even if the estimate of Lawes, Gilbert & Way be adopted, and the river be assumed to contain the whole quantity of combined nitrogen found by those chemists in the rain of Rothamstead, without a grain having been removed by vegetation, the deduction would only be equal to 985 parts in 100,000 of previous sewage contamination, instead of 320, a difference equal to less than one-fifth of the amount frequently attributed to some of the London waters in the Registrar-General's returns.

Divested in this manner of collateral issues, the arguments of Dr. Letheby may be reduced to a few simple propositions. He maintains in the first place, that the nitrates and nitrites of portable waters are not due solely to the oxidation of animal matters, but are frequently derived from other sources, and that therefore it is fallacious to use them as a measure of previous animal contamination. Under any circumstances moreover, they could not be an accurate measure, because the process of vegetation is constantly removing them from waters exposed to its action, and it constantly happens that waters known to have received sewage contamination are sometimes found to contain scarcely any oxidised nitrogen, while others which, it is alleged cannot have received any such contaminations contain much. A good illustration of this apparent anomaly was quoted by Dr. Letheby. In the months of July, August, and September, 1868, the water supplied by the Kent Company, and derived by them from deep chalk wells, was described by the Registrar-General as exhibiting a previous sewage contamination of 3660, 3660, and 3530 parts in 100,000; while that of the East London Company, derived from the sewage contaminated Lea, was returned for the same months as 0, 0, and 20.

It is furthermore urged by Dr. Letheby that it is unfair to describe by a name calculated to produce disgust and alarm, a contamination which, whatever its source, has been oxidised and rendered innocuous in the water. Sewage diluted with twenty parts of water is, he asserts, entirely destroyed in the course of a run of ten or twelve miles down a river, and it is therefore impossible for mischief to arise from the drinking of such water.

To these various hostile criticisms, cogent replies have been produced. Dr. Frankland argues upon the first point that, after the most diligent search, he has failed to discover the slightest evidence of the formation of nitrates from vegetable matters. Whenever nitrates are found in England or abroad, they can be traced generally with the utmost ease, to animal sources, and whenever such sources are absent, nitrates are absent too, although condiderable quantities of combined nitrogen may be present. It would be a wonderful thing if the water of the chalk wells did not frequently contain nitrates, considering that it is derived by percolation from the sewage and manure stained soil above. In the case of the chalk water supplied to London, the probability of direct sewage contamination is peculiarly great, for the great fault in the chalk, from which the Kent Company on one side of the river and the South Essex Company on the other, derives so large a supply of water, passes directly under the foulest part of the Thames. Dr. Frankland admits most fully that the calculation of sewage contamination is only an approximate one. In proportion as the nitrates have been removed by vegetation in streams or reservoirs, the calculation will, of course, be too low. All that he pretends to do is to show the *minimum* contamination which can have occurred, and he points out that injustice cannot be done to the water companies because he can never exaggerate, and very frequently under-states, the previous pollution of their water. It is of course true that animal contaminations of all kinds have to be reckoned in terms of London sewage. The phrase to which Dr. Letheby so much objects is by no means intended to signify that the contamination has in all cases been the actual sewage of towns. All such contaminations are objectionable in the highest degree, and there can surely be no harm in refering them to so suitable a standard as the one selected. It is employed for the comparison of different animal contaminations, just as physiologists compare different kinds of food by their *starch-equivalent*, without intending to assert that all kinds of food consist of starch; and it must not be forgotten that as applied to the greater part of the water supplied to London and other towns, the phrase simply states an indubitable fact.

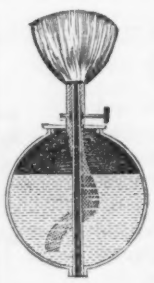
Finally, we may observe that the self-purifying power of runing water is doubted by no one, least of all by Dr. Frankland, who founds his calclation of previous sewage upon his study of it. But the absolute statement made by Dr. Letheby in regard to it—the sharp line which he draws to fix the complete purification of the water—is liable to considerable doubt. Dr. Frankland, Sir Benjamin Brodie, and many other chemists believe the process to be much less uniform and rapid than it has generally been supposed to be, and that under certain circumstances, it is even almost inoperative; but if their views were entirely erroneous, it would be none the less incumbent upon, Dr. Letheby to prove this statement. We know an absolute fact that tons upon tons of human excrement are thrown into the waters of the Thames and sea before we drink them, and we have a right to look for absolute demonstration of the complete destruction of all this filth; and not only of the filth itself—of the lifeless organic matter;—we must also be convinced that it is impossible, at all times and under all circumstances, for living matter—the low forms of life and their germs with which the processes of disease and putrefaction appear to be so closely connected—to retain their vtality under the conditions assigned by Dr. Letheby, before we can be content to accept his statement, or can learn to look with indifference upon previous sewage contamination.

It is, we trust, no discourtsey to say that the chemical methods heretofore employed appear inadequate for such a proof. The noxious matters of a water are probably beyond the reach of the test tube and the balance. They belong in all probability, to that inscrutible class in which the virus of small-pox and cattle plague must be reckoned. That they would resist the oxidising action of the water longer than mere chemical compounds, can hardly be doubted, and, indeed, it has yet to be demonotrated that the dissolved oxygen the of water has any greater destroying effect upon them than it has upon the fishes which inhabit the same streams.

New Gas Carburettor.

Our attention has been called to a new gas carburettor, the invention of Mr. Joshua Kidd, Gas Engineer, 74 Maiden Lane, New York. It is the simplest arrangement we have yet seen; it offers to gas consumers a cheap and ready means of raising the illuminating power of coal gas to any desired standard. The methods hitherto adopted for increasing the light of coal gas have been effected by bringing the gas, after it leaves the meter, in contact with the vapor of light volatile oils, such as naphtha or benzole, contained in a suitable vessel; the light inflammable vapor from the oil is absorbed by the gas, and carried through the pipes to the burners. where the illuminating power is more or less increased in proportion to the amount of vapor taken up by the gas. This method has many defects, viz.: The evaporation of the volatile oil is irregular, and varies with the temperature; condensation frequently taking place and choking up the pipes. These objections, together with the explosive character of the liquids employed, have prevented its general application.

Mr. Kidd's new carburettor, of which we give an illustration in section, removes this difficulty. His improvement consist in carburetting gas with common kerosene oil, directly at the burning point, by joining the rich flame of a kerosene lamp and a small jet of gas together; two feet of gas is instantly made equal to five feet. A two foot jet burning thirty-five hours by this method, consumes seventy feet of gas, costing at the rate of $3.50 per 1000 feet, 23 cents, and one pint of oil, costing 5 cents; total, 28 cents. The oil and gas thus combined, gives a light equal to 175, costing 60 cents; thus saving on a fixe foot jet 32 cents in 35 hours. These carburettors are sold at $2, and are made to screw to an ordinary gas bracket or pendant, and can be attached by any person in a few minutes to any gas fixtures; and by simply raising or lowering the wick, the illuminating power can be increased or diminished, as required. Hydrogen gas gives out great heat in burning, but no light. *Light is obtained* by the incandescence of the small particles of carbon in the burning hydrogen; and the reason why more light is obtained from the combined oil and gas flames, *is that* the carbon of the oil is raised to a higher state of incandescence in the hydrogen of the gas flame, than when burned alone.



Coal in the Rocky Mountains.—The Union Pacific Railway is not likely, as was at first anticipated, to suffer any inconvenience from the absence of steam fuel. A coal field, almost unlimited in extent, showing outcroppings for three hundred miles on the road, has been "struck" in Wyoming territory, in the heart of the Rocky Mountains. The locomotives are now fed almost entirely by coal, worked by the company itself, or by contractors, who furnish it at a low price. All the coal for 15 miles in the "alternate sections" on either side of the line is owned by the company. There are six miles in working order—there are others in progress. The principal mine, at Carbon Station, yielded 4000 tons to the railway company in the first three weeks in April. One of the drifts is already 540 feet in length, and there is an excellent shaft, with the usual gear, pumps, etc., worked by steam power, The thickest part of the seam so far opened is nine feet high. Hitherto neither fire nor choke damp has troubled the miners, but there is a certain amount of water in the deepest part. The miners are at present earning from $7 to $12 per day. The coal is of good quality. There is neither bitumen nor sulphur in it. It contains, by analysis, nearly 60 per cent. of carbon, 12 per cent. of water, and 26 per cent. of inflammable gases. It is to bear a new name, one which is perhaps tolerably appropriate. It is to be called "anthra-lignite," and as coal has been sold lately in Omaha, on the Missouri, at the rate of $21 a ton, whilst the company will probably sell it at half that price, it will be seen that the discovery is one of the greatest importance to the whole central portion of the continent. Iron ores have been found near it, and a good collection of coal fossils has been collected at the Carbon Station. A coal seam has also been recently discovered at Elko, on the Central Pacific Railway, which is the continuation of the Union Pacific line already referred to.

Chemical Repertory.--No. 12.

AUGUST 16, 1869.

[Much material in course of preparation for the Repertory, must be held in abeyance in consequence of absence of the undersigned, who is occupied in connection with the meeting of the American Association this week. In the next issue we hope to include a report of such matters interesting to our readers as may come up before the Association.—H. W.]

American Chemical News.

On the Effect of Atmospheric Air when Mixed with Gas in Reducing its Illuminating Power.

BY B. SILLIMAN AND HENRY WURTZ.

The data given in this article were obtained during an investigation of the Hydrocarbon Gas Process by the "*Gwynne-Harris*" or "*American System*," some notice of the results of which we propose to publish in a future number of this Journal. In the course of this investigation it became important to measure exactly the effect of atmospheric air in reducing the illuminating power of gas. Owing to a mechanical defect in the apparatus connected with the exhauster, it was found that a variable quantity of air had for some time found its way into the gasholder, the influence of which in diminishing the brilliancy of combustion was sufficiently conspicious before the cause was ascertained. The only experiments on this subject known to us when its study was undertaken by us, were those of Messrs. Audouin and Bérard.* By these results the ratio of loss in illuminating power by the addition of each one per cent. of air appeared to us so enormous, that we were desirous of confirming them. Subsequently we became acquainted with an important paper on this subject by Mr. Carl Schultz,† the main points of which are reproduced in this article; as they appear to have escaped attention; the author having modestly given us only his initials.

In conducting this research we soon found that the attempt to introduce by measure a given volume of air into the gasholders connected with the photometric apparatus, was attended with many sources of error, and that the requisite accuracy could be obtained only by the eudiometrical analysis of each successive mixture.‡ The apparatus employed consisted of two gas holders of ten cubic feet capacity each, connected in such a manner that each could be used independently, or the contents of one transferred to the other and back again, to secure a complete admixture of the contents. The air was introduced by opening a stopcock connected with the interior and adding weights to the counterpoise, measuring the influx by a centesimal scale of equal parts attached to the drum of each holder. This rude admeasurement was controlled by an analysis of each mixture. This required also the prior analysis of the street gas on each occasion. Columns 3, 4, and 5, of the accompanying Table 1, show the results of these mixtures as made known by the eudiometer. The illuminating power of each sample was determined by the Bunsen photometer, on the average of fifteen successive observations of one minute each, with the usual corrections. Columns 6 and 7 give these results, and in columns 1 and 2 will be found the corresponding densities determined by diffusion.

Since the air added in each case is rendered *as gas* by the meter during the photometric measurement, it is important to determine the illuminating power of the gas alone, after deducting the known volume of air present. The results of these calculations are given in column 8. In columns 9 and 10 the loss of illuminating power is given: in 8 in terms of the candle power lost for each admixture, and in 9 this loss is stated as a percentage, The ratio of loss of illuminating power in percentage volumes of gas and air is given in column 11, and in column 12 is the loss of power corresponding to each one per cent. of air added.

The results of the analysis and photometric measurements are more conspicuously seen in the curve projected from columns 5 and 10 of the table upon the annexed diagram, on which the vertical and horizontal scales are as 1 : 3.

[This curve we are unable to reproduce, and must refer to the original].

The following inferences depend upon the data herein given, viz:

1st. For any quantity of air, less than five per cent, mixed with gas, the loss in candle power due to the addition of each one per cent is a little over 6-10ths of a candle (·611 exactly); above that quantity the ratio of loss falls to ½ a candle power for each additional one per cent up to about 12 per cent of air; above which, up to 25 per cent, the loss in illuminating power is as shown by column 12 of the table, nearly 4-10ths of a candle for each one per cent of air added to the gas. In column 11 of Table 1, the ratio of loss in candle power is given in percentages for the several volumes, while in column 10 the destructive effect of air upon the illuminating power is most conspicuously exhibited, 12 per cent of air destroying over 40 per cent of the illuminating power. In the diagram this loss of power is represented by the numerals in the right hand column, which are inverse to those in column 10, and stand with the maximum intensity—100.

2d. With less than one-fourth of atmospheric air, not quite 15 per cent of the total illuminating power remains; and with between 30 per cent and 40 per cent air, it totally disappears.

Now, during December and January the hydro-carbon gas made at Fair Haven had often as much as 12 per cent of air in it; during the month of February the air by analysis averaged nearly 9 per cent; while in March, after the separation of the pump from the exhaustion apparatus, the air was reduced at times to nearly nothing. By column 3 of the Table it will be observed that the air found by analysis in the street gas at the Eighteenth-Street Station of the Manhattan Gas Light Company, New York, averaged nearly 2 per cent and the New Haven City Gas contained about the same quantity. We allow, therefore, this qanutity (2 per cent) as a normal amount of air in street gas; and consequently in the Journal of the daily operations with the hydro-carbon process at Fair Haven,* these corrections have been applied; giving in two columns the "corrected candle power," by the addition of the ratio determined in our Manhattan experiments, and the "corrected volume," or yield per pound of coals carbonized, air being deducted. It is obvious that the records of the station meter give the contaminating air as gas, and without the correction thus obtained the apparent yield is too great.

In large gas works the liability to contamination by air accidentally introduced by various causes, diminishes in proportion to the total make of gas, and an amount of air which, when diffused in a very large volume of gas, becomes insignificant, if confined to ten or fifteen thousand feet daily product, will become a most serious injury to its illuminating power. This cause of deterioration in gas has been overlooked almost entirely by gas engineers; but in small gas works it deserves special attention, and we have no doubt that the low illuminating power too often obtained in such works is largely due to this cause.

Results of Messrs. Audouin and Bérard.—We have already alluded to these results obtained by Messrs. A. and B. which form part of an important memoir published in 1860, under authority of the French Government 'upon the various burners employed in gas lighting and researches on the best conditions for the combustion of gas.' Their table, which we append for the sake of comparison, shows "a considerably higher ratio of loss than we have obtained, being rather more than six per cent loss for each one per cent of air added to the gas, reaching a total loss of 80 per cent with 15 per cent of air added; while we obtain 57·53 per cent loss with 16 per cent; and 93 per cent loss with 20 per cent air, while with the latter volume of air added we get 72·90 per cent loss. These differences may be accounted for by the French trials being made upon a gas of not more than 12 candle power, our trials being made on a gas averaging nearly 15 candles. Also, by the fact that in the French experiments the gas was burned from a batswing burner, ours from a standard Argand.

[It is also to be noted that as the French experiments were not accompanied, like our own, by analyses, there is entire uncertainty as to the proportions of air already existing in their several mixtures.—H. W.]

In the experiments of Messrs. Audouin and Berard, two gasholders of equal capacity were filled, one with standard gas and the other with the same gas mixed with 1, 2, 3, etc. per cent of air. Each fed a burner of the second class, regulated to a consumption of 140 litres of gas per hour. The illuminating power of the two were compared by making that of the pnre gas equal unity. The results are given in the following table, where each figure gives the mean of 6 or 8 concordant observations.

TABLE II.

Table shewing the results of mixture of air with gas, by Messrs. Adouin and Berard.

Gas mingled with Air.		Common Gas.			Gas mingled with Air.			
Quantity of air per 100.	Intensity.	Size of Flame. Height.	Size of Flame. Breadth.	Intensity.	Quantity of air per 100.	Intensity.	Intensity, Loss of	Size of Flame. Height.	Size of Flame. Breadth.
		mm.	mm.					mm.	mm.
1	0.94	49	92	100	6	0.47	53	40	94
2	0.89	48	92	:	7	0.43	58	39	94
3	0.82	49	93	:	8	0.36	64	39	93
4	0.74	46	94	:	9	0.33	67	38	89
5	0.67	46	94	:	10	0.20	80	35	86
6	0.56	45	93	:	15	0.07	93	33	83
7	0.47	48	93	:	30	0.02	98	26	79
8	0.43	48	93	:	40	0.01	99	21	60
9	0.36	46	94	:	45	0.00	100	18	47
10	0.33	47	95	:	50	0.00	100	12	24
15	0.20	46	93	:					
30	0.07	45	92	:					
40	0.02	45	92	:					
45	0.01	45	:	:					
50	0.00	:	:	:					

By this table it appears that the introduction of 6 to 7 per 100 of air, suffices to diminish the intensity by one half, and a mixture of 20 of air with 80 of gas leaves almost no illumination. Unfortunately Messrs. A. and B. do not record the actual illuminating power of their standard gas, which however we are led to believe cannot be more than 12 candles of the English and American standard.

We have already alluded to the experiments of Mr.

TABLE I.

Dates.	Densities.		Composition.			Illuminating Power.						
Gas of Manhattan Co., N. Y. 18th St. Station, from Street Mains.	Density of Street Gas.	Density after Air was added.	Air found by Analysis in Street Gas in 100 volumes.	Air found by Analysis after the addition.	Volumes of Air added.	Candle power of Street Gas before addition of Air.	Candle power after addition of Air.	Candle power of Gas alone, Air being deducted.	Loss of Candle power, by Air added.	Percentage loss of Candle power.	Ratio of loss in Candle power in percentage volumes.	Loss of Candle power for each one per cent.
1859.												
March 17	401	409	1.96	3.01	1.05	15.12	14.20	14.96	.92	6.08	5.79	.723
" 18	392	405	3.15	4.97	1.82	14 67	13.27	14.40	1.40	9.54	5.24	.511
" 23	401	421	1.50	3.75	2 25	14.71	12.96	14.37	1.75	11.82	5.25	.582
" 19	387	419	1.61	4.61	3.00	14.81	12.49	14.46	2 32	15.69	5.23	.656
" 19	387	433	1.61	6 54	4.95	14.81	11.28	13.76	3.53	23.88	4.83	.501
" 19	387	467	1.61	13.32	11.71	14.81	8.67	13.07	6.14	41.46	3.54	.419
" 20	387	490	1.61	17.79	16.18	14.81	6.29	12.41	8.52	57.53	3.55	378
" 23	403	525	1.12	21.88	20.76	15.09	4.09	11.96	11.00	72.90	3.50	.377
" 20	401	551.5	1.61	26.29	24.68	14.11	2.18	10.52	11.93	84.55	3.42	.380
(Gas burned in a 5-foot 15-hole Stand'd Argand.)	1	2	2	4	5	6	7	8	9	10	11	12

* Ann. de Ch. et Phys., 3d series, vol. lxv, p. 423, 1862, and translated in the London Journal of Gas Lighting, vol. xi, p. 733, 799, 830.

† American Gas-Light Journal, August 1, 1860, p. 41.

‡ Our labors in this research have been greatly aided by the facilities courteously extended to us by the officers of the Manhattan Gas Light Company in New York, who with great liberality placed at our disposal their well appointed experimental laboratory and apparatus at their Eighteenth-Street Station.

* *The Hydro-Carbon Gas Process.* Report of working results on a large Scale under the Gwynne-Harris Patents Nov., 1863, to May, 1869, by Benjamin Silliman, M.A., M.D., and Henry Wurts, M.A., N. Y. 8vo, pp. 126, printed for private distribution.

Carl Schultz, and annex below a summary of his results.

Mr. Schultz concludes from his experiments, that the loss of illuminating power due to the addition of air to gas, is about one-half of one candle for each one per cent of air added. He makes the very remarkable observation, that, within limits, the addition of air to *very rich* cannel gas, up to 12 per cent. of air, was followed by no loss of illuminating power, but, on the contrary, by a small gain. Thus boghead cannel gas, giving for 88 per cent gas an illuminating power of 27 47 candles, or for 100 per cent gas 31.32 candles, with 12 per cent of air, gave 28·29 candles, showing that 12 per cent of atmospheric air had increased the illuminating power of the flame by 0·82 candles. These results are obtained only by the use of an Argand burner. By substituting an intensity burner for the Argand, the results obtained with gas from boghead conform to the rule of half a candle loss for each one per cent of air. (Rev. Mr. Bowditch also states generally, that "impurities are far less destructive of light in Argand burners.")

Mr. Schultz sums up his results in the following propositions:

1. When coal gas is mixed with atmospheric air, its illuminating power for all five feet burners is reduced in the proportion of half a standard candle to every one per cent of air present, except in case of very rich gas burned with a 15 hole Argand.

2. One cubic foot of atmospheric air will destroy an amount of light equal to 10 English standard candles, during one hour.

3. This loss being constant, the percentage of aggregate loss will vary with the illuminating power of the gas used.

While our results confirm in general those of Mr. Schultz in 1860, and of Messrs, Audouin and Bérard, in 1862; it is obvious that the ratio of loss, with equal increments of air added to a 15 candle gas, is by no means constant. The difficulty of obtaining exact results, by the method of mixture of measured volumes is so considerable, especially with quantities below 10 per cent, that the only safe control of the results is that which is obtained by eudiometrical analysis of the several mixtures tested, as was done by us in all cases both before and after the addition of air. It is obvious that the surprising loss of intensity by the addition to illuminating gas of small percentages of air must be owing not merely to the interior combustion due to the presence of oxygen, but still more, probably, to the associated nitrogen, which acts not only as a diluent, or deductive quantity, but its specific heat is an actual *divisory* function in diminishing the flame temperature. The interesting observation, first made by Mr. Schultz, that in very rich cannel gas, there is actually an increase of intensity within certain limits due to the presence of oxygen, suggests another series of experiments with successive additions of oxygen to a gas of high illuminating power, which we propose to undertake at our early convenience, as also another series upon mixtures of progressive quantities of carbonic acid.

May 17th, 1869.

NOTE.—Erdmann's Photometer ("Gasprüfer") depends on the use of air to destroy the illuminating power of gas. Elster has employed this instrument in a series of researches undertaken to determine the theoretical illuminating power of different materials (*Journal fur Gasbeleuchtung*, Munich, 1862, p. 384, *et seq*). After removing the illuminants by sulphuric acid he found that ordinary illuminating coal-gas required 150 volumes of air to destroy completely the yellow flame of 100 volumes of gas. If the amount of light obtained by the addition of one per cent of olefiant gas to the decarburetted gas employed in a definite burner, is called *one candle*, it was found necessary to add 6·5 per cent of air to destroy the illuminating power of this gas containing one per cent of olefiant gas or to destroy one candle power. As a like quantity of carbon, carried to a white heat, produces always, in a gas burning from the same burner, the same quantity of light, and it requires the same quantity of air to transform it into carbonic acid, we may regard an ordinary 12-candle gas as a mixture of an unknown non-luminous gas, holding in suspension during combustion a quantity of white-hot carbon, equivalent to 12 per cent of olefiant gas, and requiring, consequently, a quantity of air equal to 210 volumes for 100 volumes of gas (88 into 15+12 into 6·5=210). Each additional candle power requires an addition of 5 volumes of air, as the constant indicated by these results of Elster.—*Translated from Schilling, French Edition of* 1868.

In the use of the Erdmann apparatus, it is found that the volume of air required completely to destroy the illuminating power of coal-gas ranges from 188 to 245 volumes per 100 vols. of gas, varying with its richness.

These results, it will be observed, harmonize in a satisfactory manner with those obtained by us, as embodied in Table I.

Every chemist will at once recur, also, to the action of air upon gas in the Bunsen burner in constant use in all laboratories provided with gas—an instrument identical in principle with the *Gasprüfer* of Erdmann.

Report of the Portland Gas-Light Company.

The following is the annual report of the President of the Portland Gas-Light Company, to the stockholders, at their annual meeting held July 21, 1869:

Gentlemen: In accordance with the views of the directors, expressed in the report to the stockholders at their last annual meeting, it was determined, soon after, to build a new telescopic gasholder, of two sections, each 20 feet high, and the upper section of 80 feet diameter.

The work was commenced immediately, and has since been prosecuted in a satisfactory manner, and as fast as was desirable. The excavation for the tank was difficult, on account of the character of the soil, and it was necessary to pile the bottom thoroughly, in order to get a good foundation. The walls of the tank were built up last fall to within about four feet of the top, then boarded over and secured from the frost. This spring the wall was completed and the bottom built. The work has all been done in the most thorough manner, and the tank appears to be right every way.

The work of building the holder is going on satisfactorily, under contract with Jesse W. Starr & Sons, of Camden, N. J. The columns and girders are in place, the lower section is nearly completed, and the rest of the iron work is here and ready to be put together. It is expected that the holder will be completed and in working order in October next. The whole cost will not vary much from the original estimate of $50,000. The directors propose to issue new stock to that amount, which will be offered to the stockholders at the rate of one new share for every six now held—of which due notice will be given.

The exhauster and steam engine, which have been in constant use for eight years past, had become worn, and new ones have been purchased, and will soon be in operation, at a cost of about $3,000. Many other lesser repair and improvements have been made and are in progress; and it is believed that the works will be in thorough order by the coming autumn.

An improvement in the manufacture of gas has been introduced into our works by the engineer, Mr. William Yorke, which the directors consider of great value to the company. It is McIlhenney's patent vacuum process, the effect of which is to remove all pressure from the retorts while the gas is making. The quantity of gas is increased by it, the quality improved, and the formation of carbon is prevented—all the carbon going to enrich the gas, instead of accumulating in a solid form in the retorts, as formerly. This accumulation impaired the working capacity of our retorts so seriously, that it was necessary to remove it from time to time, by burning out: an expensive process in time, labor, and fuel, and one which left the retorts in a leaky condition, entailing a further loss of gas.

The improved process was set in operation in March last, and the yield of gas was at once increased from less than four feet and three-tenths per pound of coal, to upwards of four feet and seven-tenshs per pound, and of improved quality. The increased yield has been maintained ever since, and there has been no deposit of carbon in the retorts.

There has been an increase in the consumption of gas of upwards of four million feet the past year, being 38,902,000 feet against 34,550,000 feet for the year ending June 30, 1869.

The loss of gas by condensation and leakage is nearly ten per cent. There has been an unusual number of breakages of the street mains and service pipe, from excavations in the streets the past year, by which large quantities of gas were lost at different times. Most of them were caused by the settling of the earth after the excavations were filled, and were not discovered for several days. Independent of these extraordinary accidents, our percentage of loss would be very moderate.

The number of consumers is 2,325 against 2,201 last year; an increase of 124. The number of street lanterns in use is 342, an inceease of 32 during the year. Three thousand eight hundred and fifty-nine feet of main pipe have been laid during the year, making the whole extent of our mains about 22 miles.

The directors have been able, from the increased business of the company, to add one dollar per share to the usual dividend of four per cent., in part compensation to the stockholders for the dividend lost by the great fire in July, 1867; and unless something unforseen occurs, they feel assured that the earnings of the company will be sufficient in future to pay the usual dividends, notwithstanding the proposed increase of the capital stock.

The report of the Treasurer will show the financial condition of the company.

EDWARD H. DAVEIS, President.

Inspection of Gas.

OFFICIAL REPORT OF PROFESSOR AIKEN.

Professor William E. A. Aiken, Inspector of Illuminating Gas for the city of Baltimore, makes the following report for the quarter ending July 1st, 1869, of the average of the observations on the illuminating power, etc., of the gas supplied by the Baltimore Gaslight Company:

To the Hon. Robert T. Banks, Mayor, etc.

The undersigned begs leave to report, as below, the average of the observations on the illuminating power, purity, and pressure of the illuminating gas supplied by the Baltimore Gaslight Company during the past quarter:

Months.	Illuminating Power in Candles.	Sulphur Gas in 100 cubic feet.	Ammoniacal Gas.	Sulphuretted Hydrogen Gas.	Carbonic Acid Gas.	Pressure in Main, Maximum.	Pressure in Main, Minimum.	Burning Pressure during Trial of Gas.	Maximum Illuminating Power.	Minimum Illuminating Power.	Temperature of Photometer Room.
April	16.1	0	Excess	0	0	3.6	2.0	.2	17	14	56F
May.....	16.9	0	"	0	0	3.6	2.5	.2	17.6	15	58F
June.....	16.8	0	"	0	0	3.6	2.6	.2	18	15	70F
Quarter ...	16.6	0	"	0	0	3.6	2.0	.2	18	14	

WILLIAM E. A. AIKEN,
Inspector of Illuminating Gas.

REMARKS.—The gas during the last quarter has been above the standard, both in illuminating power and purity. With proper gas fixtures and burners there ought not to be any complaint of insufficient light. The ammonia in the gas, though constantly present, is very slightly in excess, and the sulphur has never been found in greater quantity than about 6 grains to the 100 cubic feet of gas. The ordinance says the sulphur shall never exceed 20 grains to the 100 cubic feet, and as long as the quantity present is less than 10 grains, it is marked 0, or wanting, in these reports. Should it ever exceed 10 grains the quantity present will be reported. The remaining impurities, sulphuretted hydrogen and carbonic acid, have not been present in sufficient quantity to be manifest by the ordinary tests, and therefore have been marked absent.

The following is Professor Aiken's report of observations for the week ending July 24, 1869:

Illuminating power in candles.	Sulphur grs. in 100 cubic feet.	Ammoniacal Gas	Sulphuretted hydrogen gas.	Carbonic Acid Gas.	Pressure in main maximum.	Pressure in main minimum.	Burning pressure during trial of Gas.
16.5	0	Exc'ss	0	0	3.7	2.6	.2

REMARKS.—The gas continues very uniform. The range in illuminating power during the week has been from 15 to 17 candles.

The Patent Laws of England.—The Lord Chancellor has decided a point of interest to the registrars of patents. An intending patentee had lodged a provisional specification, when another inventor filed one of a similar description, and procured his patent to be the first sealed. The former complained of this, and argued that under the circumstances the Attorney-General should not have allowed the second person to file his patent. The Lord Chancellor, however, pointed out that there was no law to compel a person who had filed a provisional specification to proceed with his invention, and if the applications of other parties were to be uniformly rejected, the country might be deprived of the fruits of the ingenuity of many minds which were working in the same direction.

Correspondence.

[Correspondents in all cases should sign their communications with their names and address in full, not necessarily for publication, but as a guarantee of good faith.—Eds.]

A Tilt with a Correspondent.

TERRE HAUTE, IND., July 28, 1869.

Messrs. Editors: Knowing that you desire nothing better than to have gas men engage in a courteous *tilt* with one another, with the end in view that information may be elicited, I have taken my pen in hand for a friendly expression of opinion on the various correspondence in your last issue.

I am somewhat surprised that our friend at Madison is not sufficiently a critic to perceive that "Our Correspondent" of the GAS-LIGHT JOURNAL from Cincinnati was not a "gas man," or he would not have been guilty of writing this sentence: "When it occurred there was no fire in the cauldron, etc." This conclusively proved to our mind that he used the term "meter" in the caption of the article, as synonymous with "gasometer," in the seventh line.

"Collapse" says "he gave some theories on the subject, such as solar heat," etc. Now, in our opinion, he merely mentioned the fact that some one had advanced the theory of solar heat being the cause of the explosion.

By the by, Messrs. Editors, you are aware (although you did not see the article) of what some of our western engineers and superintendants who read the communication to the *Cincinnati Gazette*, may not have discovered that the whole article on "solar heat" being the cause of the explosion, was a hoax on that paper and the St. Louis *Republican*, for their persistance in maligning gas companies, gas engineers, and superintendants, for accusing them constantly of deteriorating the gas, and practising all kinds of frauds upon consumers. When editors lower themselves so much as to traduce and vilify a class, and endeavor to poison the minds of the community against all manufacturers of gas, simply because they wish to break up an obnoxious corporation, and have the control themselves of a "big thing" like the Cincinnati Gas Works, I think it serves them right if they should occasionally be *sold*; especially when it led the editor to call particular attention to the article, and assert "that chemicals were introduced by gas companies into the holders, in order to adulterate the gas"; of which nothing of the kind was adduced in the article alluded to; the hook was baited so nicely that the editor did not see the *point* of it, and gulped it down at one swallow.

But to return to "Collapse." He says, "The truth is, Mr. Editor, the most of those who have written on the subject, know but little or nothing of what they write." Did the writer ever read the couplet from Burns:

> "Oh! wad some power the giftie gie us,
> To see ourselves as ithers see us."

If so, he might do, as he says the gasholder has done.

I perhaps may be, in this respect, in the same boat with our neighbor: but we should not like to give any opinion as to the cause of the catastrophe, without more full information on the subject, than has yet been given to the public.

Before forming a conclusion I should like to know,

1. The size of the gasholder?
2. Was the gasholder telescopic or single lift?
3. Was the tank nearly full of water, or (as I have heard asserted) was the water some three or four feet below the curb?
4. How many sheets was the gasholder in the water? (For I may judge it was not ten or twelve feet, or five or six sheets, in the water; for in that case the gas would not be likely to be shut off from it, as it would hold some 180,000 cubic feet more, unless no more was run in it for the accommodation of the workmen in getting up and down from it.)
5. Did the holder actually leak to such an extent as to warrant the opinion of the engineer, that sufficient gas escaped from the leaks on the top to allow (if it were possible, which we doubt) such a combination of gas and air, as to cause an explosion "directly on the top of the gasholder," as to cause it to be driven down with such force into the water as "to compress the gas, till the outward pressure became so great that the crown sheets were unable to resist it, and they split open, as described,"

I judge it did not leak to that degree from several causes, which I think would be controlling in such a case:

1. No sane engineer would have permitted his holder to get into such a state, nor would he have introduced gas into any holder when in such condition.
2. He would have attended to stopping the leaks in the crown before painting the sides, and would have done *that* work while the holder was on its base, thus taking off all pressure.
3. If it had leaked to such an extent, the men engaged in repairing the crown would have been asphixiated.

There is another point we should like information on; that is, how the amount of gas in the holder at the time of the occurrence was estimated? It might have been by counting the number of sheets above the curb, which would show the amount of gas in the holder, available for consumption at 6 o'clock, A. M., when the inner valve was said to have been shut off; but if, as before hinted, the water was three or four feet *below the curb*, there would be (125′ x 42′) a larger quantity of gas in the holder (at 3 feet about 37,000 cubic feet; at 4 feet about 50,000 cubic feet more) although unavailable, than that estimated; then taking the effect of the direct rays of the sun at 12 M., the seal would be nothing like the amount stated by "Collapse." But on all these important points of consideration I am entirely in the dark, consequently no intelligent opinion can be formed.

I think it is due to the gas world, that the Cincinnati Gas Light Company should assemble a number of scientific and practical experts, to whom every facility should be given, to ascertain the facts in the case, that a correct judgment might be arrived at in the premises.

If, as stated so positively by "Collapse," that there never was an explosion, what made the "loud report" which startled the city, and first called the attention of the engineer to the gas holder?

If a collapse took place without an explosion, what made "the gas holder split open across the crown, the gas holder opening ten feet in width?"

What becomes of the engineer's assertion, "that in less than three minutes from the time of the *explosion*, the gas had all been consumed?"

The collapse did not take place until after the report—until after the opening in the top—until after the gas was all consumed. "Collapse" will have to try again. The query of E—— n of Fort Wayne is to the point. We would like "Collapse" and "Rankin" to solve that problem.

Rankin's holders are thirty-one years old, and good as new. The Cincinnati holders were only about ten years old; consequently it is clear, old age was not the cause of the holders leaking to such a wonderful extent.

Yours, etc. R.

Compressibility of Water.

NEW YORK, August 7, 1869.

Messrs. Editors: In answer to the "Gas Man" who wants information in regard to the density of water at great depth, I will state that Oersted's apparatus proves that this density increases only 150 millionth part for every 100 feet depth, or 15 thousandth parts for 10,000 feet, so that when the density at the surface is taken as 1, it is 1.00015 at 100 feet, 1.0015 of 1000, 1.015 at 10,000 feet, and 1.04 at the depth of nearly five miles. Thus it is seen that this increase is so small, that it can be neglected for all practical purposes, and that the popular belief that there is a depth at which it is so dense that the bottom of the ocean will float, is an absurdity.

The apparatus of Oersted, mentioned above, is well known and described in many text-books. It was always used by me when lecturing on this subject, as it settles this matter beyond the shadow of a doubt. It appears strange that this error is so continually repeated on all sides, as this is perhaps the twentieth time that I have written on the subject to different papers, correcting it.

Yours, etc.

P. H. VANDER WEYDE, M. D.

P. S.—In your paper of 2nd inst., I find on page 23, that a correspondent mentions an articie on this subject in the *American Artisan*, under the title "Water not yet understood." Allow me to remark that the writer of it falls in the opposite error, in supposing that water is utterly incompressible. I have, in a sub sequent number of that paper, attempted to prove, that at least, in this respect, water is pretty well understood.

P. H. VANDER WEYDE.

Bessemer Steel Manufacture.

The progress of the steel manufacture in Great Br tain, by the Bessemer process, is being pushed forward on a scale of magnitude, and with a disregard of expense which are astonishing. The English engineering and scientific journals refer often to the subject, and give descriptions of some of the establishments of this kind which are growing up in England. It is stated that in one place in Lancashire not long since entirely unknown beyond the immediate locality, excepting for an old monastic ruin called Furness Abbey—and where, until a few years ago, a population numbering only a few hundreds, were slowly working the mines of iron in the vicinity—there has sprung into existence, in seven years, an active, bustling, thriving, and still rapidly-growing town of over 20,000 people. This town—Barrow-in-Furness—bids fair apparently to rival in prosperous industry and rapid rise any of the cities of our teeming, go-ahead West. The stimulus to which this rapid rise in the first instance was due, is said to have been the erection of blast furnaces on the spot for the production of pig iron from the red hematite ore belonging to that district. The ironstone mines had been worked there for a considerable time, when some enterprising gentlemen erected blast furnaces at Barrow, which were worked with extraordinary economy, and with consequent commercial success.

Some of the important elements of this success were the excellent construction and arrangement of their furnaces; the situation convenieat at once to the seashore and the mines; the advantage of obtaining coke and coal as return freight from the places to which hematite ore was carried; but the most decisive and important cause was the adoption of the Bessemer process, which had no sooner got into practical use than there arose an almost unlimited demand for hemalite ore We see it stated that the Barrow Furness Works have in operation twenty-four steam engines, and consume of coal, ore, lime, etc., 12,000 tons weekly; consume also all the waste gases from the blast furnaces. The production exceeds 5000 tons per week. They keep a reserve of 40,000 tons of coal, in case of interrupted supply. They have become the centre of a railway system which feeds this one manufacture, and distributes the mineral products of the region. It produ ces at the rate of one quarter of a million tons of iron and steel annually, and it has created on the spot a shipping port which will accommodate at the docks owned by the company, ships of 1,500 tons burden.

Establishments on, of course, a smaller scale have been successfully undertaken in our own country. In the valley region of Virginia operations have been carried on for converting iron ore into steel, in which, if we mistake not, some citizens of Baltimore are interested. The substitution of steel for iron in the track and rolling stock of railroads might effect a saving in repairs that would reduce the cost of transportation and travel nearly one half Our own city, centrally situated as it is, possessing unlimited manufacturing and mechanical resources, having vast facilities for water and railroad transportation, and a convenient market in the South and West, ought to lead the way in a manufacture which must affect the affairs of nations in peace and war, and produce a revolution in agriculture, manufactures, and commerce. In England, while there are complaints from the iron districts of the few orders for rails, the activity of the manufacture of steel rails continues unabated. On nearly all the large railways the steel rails are admitted to effect a very great saving. The Great Indian Peninsular Railway, which has now about one thousand miles open, and will be upward of thirteen hundred miles when completed, and the Grand Trunk of Canada line, are to be laid with steel rails. rails. Our Baltimore manufacturers and mechanics have a field before them in this direction which will amply reward their enterprise.—*Baltimore Journal of Commerce, August* 5.

The Production of Oil from Coal.

When shale or coal is submitted to distillatory treatment, the most volatile portions at first escape, leaving behind substances of continually decreasing volatility. As the operation proceeds, and on an increase of temperature, these are evolved in a gaseous form unchanged, or resolved into more volatile matters and residual products possessing a still greater fixity. These products vary in nature with the temperature to which it is distilled; at a red heat it yields a large quantity of gaseous and but a small amount of liquid hydrocarbons. The proportion of liquid products is much greater at a lower temperature. Coal-tar obtained from the distillation of coal contains various basic substances, including ammonia, aniline, diculine, chromoline, pyridine, toluidine, and others possessing less importance. The acids include acetic and rosalic, among others, but the principal acid is carbolic or phenic.

The first products from the distillation of the tar are gases, then follow water and ammoniacal salts, with black oily matter. As the process continues, the proportion of watery products decreases and that of oil increases. The products become heavier than water when from five per cent. to ten per cent. of the original quantity has passed over in the form of light oil. It must be remembered that as the light oils disappear from the still, the remaining substances become more fixed, and a higher temperature is required for heavier oils. As the products increase in density, creosote or "dead oil," appears; naphthaline and other solid products then become abundant, and the oil assumes a viscid state; the final residue constitutes asphalte if the distillation be carried to a sufficient extent.

The light oils on rectification can be made to produce a still greater portion of heavy oil and crude naphtha. The heavy oils contain a number of hydrocarbons of high boiling point. If the crude naphtha be agitated, the supernatent liquid on rectification gives rise to highly rectified naphtha, containing at least four or five oils, with specific gravities ranging from .860 to .890, and with boiling points from 149° to 392° Fahr. The watery liquids produced in the condenser during the manufacture of gas are employed for the production of sulphate and chloride of ammonium by a process of concentrating, crystallizing, and sublimating the crystals.

At the Ardsley Works, the retorts are fifty in number, and of an oval form. They are arranged in two sets of twenty-five each. Each retort weighs about 2½ or 3 tons, and contains from 10 to 15 cwt. of coal. The crude oil from the retorts is pumped into the stills, three in number, each having a capacity of 1,500 gallons. A small fire is placed under the stills, but the chief part of the heat is communicated to the body of the oil by means of superheated steam in a wrought-iron pipe entering the top of the still and carried nearly to the bottom, where it forms a coil, which is perforated with small holes; steam is thus blown into the body of the oil. The amount of water introduced into the oil by the condensation of the steam is inconsiderable, and is readily separated. The distilled oil is collected in a tank from a coil laid in a cistern of cold water in the usual way.—*Mechanics' Magazine.*

How the Atlantic Cable is Worked—The Process of Ocean Telegraphing.

We find the following interesting account of the working of the Atlantic Cable in a recent lecture by Hon. Wm. J. McAlpine on the subject of "Modern Engineering."

TELEGRAPHY.

Telegraph may, with propriety, be considered one of the branches of engineering, and is peculiarly of modern development. A clever writer says that it may be read by each of the five senses. On land lines each signal is made by suspending the flow of the electric current, for two different intervals of times, called "dots and dashes."—the use of which, in different orders, constitutes the alphabet, of the telegraph. When these are printed, they read by "sight," but ordinarily the operator reads them by "sound," as easily as the musician reads the letters of the scale by the same sense. If the operator has no instrument, he will grasp the wire in his hands, and read the signals by "feeling" the intermissions of the flow of the electric current. In like manner, by placing the wire across his tongue, he can "taste" the same intermission (but this is a dangerous experiment). And it is said that the electricity can be made to dissolve a chemical and produce a pungent odor in the telegraphic alphabet, which can be read by "smelling," but for this, I do not vouch. I believe that the method of signaling through the Atlantic Cable is known in detail to but few persons. The operation is exactly reversed from that on the land lines. The gutta percha covering of the copper wires, under the pressure of a great depth of water, becomes an absorbent of the electricity which is being sent through them to the extent of 90 per cent. The first portion of the electric wave of 10 per cent crosses the ocean (1,700 miles) in two seconds, and it would be followed by a succession of wave from the restoration of that portion of the electricity which has been absorbed by the gutta percha in impulses, and the signal would be repeated like echoes, and produce not only confusion, but great delay. To remedy this, Professor Varley introduced a key, which sends alternate currents, positive and negative, at such intervals as allow the first wave of ten per cent. to pass forward, and then that portion absorbed by the covering is neutralized by its opposite, and the cable is cleared for the transmission of a second pair of currents. The battery used is a very small one (three of Daniel's cups), and the signal being only 10 per cent. of this small current, is powerless to move any of the other instruments in use on land. The instruments consists of a minute polarized needle, suspended on a single strand of a spider's web, or one from the silk worm. In the middle of this minute needle is placed an almost microscopic mirror, which reflects a single ray of light from a powerful lamp. The currents of electricity effect this needle alternately to the right and left for a space of time corresponding to that occupied in the signal on the land line, the same kind of alphabet being used in both cases. The receiver (not operator) sits in a dark room, and the small mirror reflects the ray of light upon a piece of paper before him, on which a black line is drawn, to right and left of which the light is alternately reflected. The receiver reads these signals by "sight" and transmits them to another person, placed outside of the dark room, by means of an ordinary instrument. A short time since, General Reynolds told me that he had sent a message, without either wire or cable, ninty-two miles, across an arm of Lake Superior, by means of the Heliotrope or mirror, and on the return of messenger (who had been sent with the written copy), he found that the Heliotrope message had been received, understood, and obeyed. He had two assistants, who had been telegraph operators, who had for a whole summer been amusing themselves in talking to each other with these instruments, though they were stationed 10, 20 or 30 miles apart. When the rebel General Morgan made his great raid through Indiana and Ohio, he captured one of my operators, and compelled him to telegraph, in General Lew Wallace's name, to Cincinnati asking how many regular troops were in that city, Morgan read by "sound," and therefore the operator did not dare to intimate that he was under duress, and could only venture to add an extra initial to his own signature. The receiving operator at Cincinnati knew that Morgan was in that neighborhood, and suspecting from the extra initial letter, that all was not right, replied, greatly exaggerating the force of regulars; and the consequence was that Morgan changed his route to a circuit of 20 miles beyond the city, and thus saved it from a sack, and the probable loss of millions of dollars.

Gas and Parsons.—Rev. Newman Hall communicates to the *Independent* an incident which recently occurred in one of the outdoor meetings which he has been holding. A free-thinker who happened to be present rose and said he came to hear about temperence, but that in his opinion the man who invented gas had done more to enlighten the world than all the parsons. Quite a disturbance ensued, but a friend of Mr. Hall at once begged for a fair hearing even for the objector; and then being himself called up, he said "Mr. chairman—I'm for free thought and for free speech; and yonder gentleman has a right to speak and think for himself as much as I have. (Loud cheers from the friends of the objector.) That gentleman says he considers the man who invented gas did more to enlighten the world than all the parsons. Well, if that is his opinion, he has a right to hold it, and a right to maintain it. But, whatever our different opinions, there is a time coming to us all, which we call death, when most men are somewhat serious, and like to get advice and comfort respecting the world they are going to. Now, when this season comes to our friend, I would recommend him to send for the gas man." An immense sensation with a tumult of applause followed with sally, which, Mr. Hall says, was better than a sermon, and not likely to be forgotten.

Smedberg's "Synopsis of Gaslighting."

The following subscriber to the above work is acknowledged, making in all 206:

John Dunbar, Sup't New Albany (Ind.) Gas Co.
Samuel Purnell, Omaha, Nebraska.

A Cable to Germany.

Since the successful laying of the French Atlantic telegraph cable, says the Baltimore *Journal of Commerce* of 5th inst., the project of a German-American cable has been seriously discussed, and it is announced that the Prussian government proposes to lay a submarine cable between that country and the United States. The relations existing between this government and the German States are as intimate (and certainly more friendly) as between it and the English and French governments, while the popular connection is very much closer. The great mass of United States securities are held by the Germanic family, and there is without doubt a stronger bias toward the great Republic on German soil than anywhere in Europe. Government aid on both sides of the ocean would therefore, very truly, remarks the Washington *Express*, not be out of place. There is no doubt that any amount of stock for such a cable could be secured in this country, almost regardless of what the dividends might be. At present the message rates of the English cable are entirely too high to be of any use to private individuals, except in large commercial enterprises, and the French line will probably not materially lessen the charges. A third cable might bring down the rates so as to put the wires within the reach of persons of moderate means. If so, a large number of people in this country who have relatives and property interests in Europe would be benefitted, and the telegraph company would be able to make up in the number of messages for the loss sustained by a reduction of rates. To do this would, however, require a greater carrying capacity in the new cable than that of those already laid, which no doubt could be secured to a limited extent without much additional cost. To this end, therefore, the attention of scientific and practical men should be directed, for the business and social relations of the people of the two continents must become more and more intimate. What has been gained already will not be surrendered, or even allowed to stand still. More ocean cables of greater capacity and of cheaper rates must and will be laid. If an American-German cable is to be laid let it be an enlargement and improvement upon its predecessors.

MISCELLANEA.

Aluminium Bells.—It appears that some Belgian manufacturer has just had a bell cast of aluminium, and with good results. It is of course extremely light, so that, though large, it can be easily tolled; its tone is reported to be loud and of excellent pitch Aluminium is the most sonorous of all metals.—*Engineer.*

A new alloy, forming a beautiful white metal, very hard and capable of taking a brilliant polish, is obtained by melting together about seventy parts of copper, twenty of nickel, five and a half of zinc and four and a half of cadmium. It is, therefore, a kind of German silver, in which part of the zinc is replaced by cadmium. This alloy has been recently made in Paris for the manufacture of spoons and forks, which resemble articles of silver.

Shade for Gas Burners.—This is the invention of J. F. Travis, of New York city, and consists in a translucent disk, connected with or applied to the bottom of a shade of a gas or other burner for illuminating purposes, whereby the rays of light reflected downward from the sides of the shades are partially refracted and mellowed by their passage through the said disk, thereby giving a softer and more agreeable light.

Cure for Smoky Chimneys.—Inflate a large ox-bladder with air, and tie it by the neck to the middle of a stick, which place across the insids of a chimney, about two feet from the top, or at the foot of the chimney-pot. The buoyancy of the air keeps the bladder continually in a circular motion, and thus prevents the rush of air into the tunnel from descending so low as the fireplace.

A New Agent in Blasting Operations.—The Oswego *Advertiser and Times* of June 18, says: We saw, yesterday, a novel experiment involving the explosive power of gas. In the new tank excavation, now in a forward state, at the gas works in this city, an old well had been pumped out and then filled up after leaving an aperture beneath. Into this space a limited quantity of gas was introduced from the gas pipe, sufficient to form an explosive compound with the air in the covered well. A match trigger touched off the mine, when a general upheaving of the surrounding earth took place.

Transmission of Gases Through Colloid Substances.—In a recent lecture at the Royal Institution, Dr. Odling said, in regard to the transmission of gases through india rubber, etc., that the "gas appears to be condensed at the nearest surface and to pass through the pores of the material as a volatile liquid, which evaporates on the other side. He took a long glass tube, with its upper end closed with a single thickness of calico. When the tube was half filled with colored liquid and its lower end placed in a dish of water, the water in the tube ran out, because of the rapid passage of air through the hole in the calico. But when the calico was wetted with water, the column of liquid was sustained in the tube, as air could enter then only by dissolving in the water and evaporating on the other side—a very slow process. Ammonia being very soluble in water, passed through quicker, which the lecturer proved by inverting a jar of ammonia over the wet calico, thus causing the liquid in the tube to descend more rapidly. Liquid ammonia dropped upon the wet calico was also seen to act more vigorously than the gas which had to dissolve in the water before it began to pass."

Another Bergen Tunnel.—The Delaware, Lackawanna and Western Railroad Company have in contemplation the cutting of another tunnel through Bergen Hill for their road, instead of using the Erie tunnel as at present. The *Patterson Press* says, surveys have been made for running their road (Morris and Essex Division) to Hackensack river in a straight line across the Erie track, entering the hill at a point two or three hundred yards north of the present tunnel, coming out on the east side of the Hundred Steps. The route proposed is a straight line from the Hackensack river to Hoboken, saving two or three miles in distance. That another tunnel is needed is evident, as upwards of 200 trains now pass under the hill. It will probably take two years to bore another hole though big enough, and by that time 200 or 400 trains will daily pass over the Erie, Northern, Delaware and Lackawanna roads, to say nothing of two or three new roads wanting access to New York from New Jersey.

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[NOTE BY PROFESSOR WURTZ.—Contributions and items for which I am, as a Scientist, individually responsible, will have attached my full name or initials.—H. W.]

MONDAY, AUGUST 16, 1869.

WISHING TO MAKE this Journal an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers elicit letters from all among them who make the study of those subjects a pleasure, or a profession.

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METHODS OF VENTILATION.

In our last issue we promised to continue this subject, by showing some of the methods to secure proper ventilation in public and private dwellings, which we now proceed to do, and trust that it may meet the views of our readers and profit thereby. In a work published by E. E. Perkins of Philidelphia, he says:

A *contrivance* has lately been introduced for ventilating rooms; but when there is a fire in the room, it must serve the purpose of introducing air rather than letting it out. It consists of a number of strips of plate glass, arranged after the fashon of a Venetian blind, occupying the position of one of the panes of glass, in the upper window frame. By a little adjusting motion, the strips can be separated more or less apart to regulate the supply of air, or closed entirely, so as to exclude it. Perforated panes of glass have also been introduced as ventilators, but they must also bring air into the room, instead of letting it out, when a fire is burning.

But the fact is, whether the ventilation of a room or building be left to (what for want of a better term we will call) chance, or whether any special apparatus be erected for the purpose, *the foul air is to be got rid of, and fresh air substituted for the purpose of respiration, admitted* in sufficient quantities; that is, at the rate of about four cubic feet per minute for each individual in the said room or building.

Tredgold, in his work on warming and ventilating, (second edition, London, 1836,) has given some very sensible directions for the ventilation of a church, which, of course, apply equally to any other public building, and, to a certain extent, to private houses. He advises that the spaces for admission of cold air be abundantly large, and divided as much as possible; they should be in or near the floor, so that the air may not have to descend upon any one; by making the openings large, and covering them on the inside with rather close wirework, (sixty-four apertures to the square inch,) most of the current may be prevented; and it may be still further prevented by bringing tubes under the paving to admit fresh air into the central parts of the church. Of course, these openings must be provided with shutters, so as to close wholly or partially, when desirable. Provision should be made for the escape of the warm air at different parts of the ceiling, through air-trunks furnished with registers. The form of the mouth of the vent-tube is circular, with a balanced circular register-plate, to close it. This plate should be larger than the aperture, in order that the air may be drawn into a horizontal current, for the purpose of taking away the portion of air next the ceiling. If the tube were left without a plate, the air immediately under it would press forward up the tube, and very little of the worst air, which is that which collects at the ceiling, would escape.

A flat or level ceiling (one illustration of a right angle) is not calculated for ventilation, nor adapted to it; but a still worse form of ceiling is that which is divided into coffers, for in these the air collects, gets cooled, and descends. For effective ventilation, ceilings ought always to be dome-shaped, coved, arched, groined, or of the form of a truncated pyramid, so as to rise in the centre; and at the centre, or most elevated point, the ventilating pipe should be placed. When curved lines are not used, ceilings of this form ought always to be adopted: they are not much more expensive than flat ones; they have a better effect to the eye and for sound, and are vastly superior as far as the important point of ventilation is concerned, always supposing an opening be made in the central or highest point for the escape of the vitiated air.

As it is not always possible to conduct the vent-tube at once in a vertical line from the highest point of the ceiling, there is no objection to giving it a horizontol direction for some distance.

In designing and constructing a new building, flues might be made for the special purpose of supplying the interior with fresh air. Each flue might open in the cornice, pass down between the piers, and under the flooring of the church or other building, and terminate in apertures which could be covered with gratings. By disposing some of these flues on each side of the church, they would act with the wind in any direction. These exterior openings should, however, be covered with a grating, to prevent foreign matter blocking them up.

In some of the old buildings which still excite the admiration of persons of cultivated taste by the beauty of their arrangements and architectural details, we sometimes meet with very special provision for ventilation, arranged on the truest principles. Thus, in the "*Hall of the Baths,*" in the Alhambra, in Granada, the roof is perforated with ventilating openings; and is not only of the best possible form for the purpose of ventilation, but the openings themselves are of the best possible shape, being wider at the lower extremity than at the upper; and in order that these openings may present the least possible amout of friction to the outgoing air, they are provided with short tubes of baked earth, covered with a green vitreous glazing.

Such are the methods by which churches and other large buildings may be spontaneously ventilated. In the rooms, too, of private houses, the ventilation must be spontaneous; for if the slightest trouble be entailed on the aids, even to the opening of a window, it will be neglected. The means for ventilation must also be cheap, easily procurable, always in place, self-acting, not liable to get out of order, requiring no adjustment when once fixed, and requiring *no care whatever* on the part of the inmates. It would seem impossible, at first view, to contrive any thing at all likely to answer these conditions, and yet it has been done in the most perfect manner by that good man, Dr. Arnott, without seeking or desiring any emolument to himself.

Before entering upon what Dr. Arnott did, or proposed to do, the author appeals to the right feelings of the proprietors of tenant property in the cities in particular, and to those of every town and village in the United States, and proceeds to say:

Gentlemen:—As personally unknown to you, we will presume to address you with a frankness generally considered equivalent to an apology, and which is most certainly the best pasport to a patient hearing upon any subject; but when what we have to say relates to the listener's benefits and duties, he is tolerably sure of being attended to. Then, if what we have to say be true, the more directly we state what we have to state, the better. Now, gentlemen, this is just your case and ours; and we without reserve, ask you urgently at once to advocate *ventilation*, by practically putting it into operation in every apartment upon your rent-roll, agreeably or proximate to the plan Dr. Arnott suggested. We ask you fearlessly.

1. Because it will cost you nothing.

2. Because it will better the health of the poor individually.

3. Because it will be a step in the right direction, to prevent sickness and check contagion among the poor generally.

4. Because the whole community will be bettered by it, yourselves included.

5. Because your tenants, by having good health, will be able to pay their rent regularly.

6. Because labor will not be so impeded as when epidemics are rife, and which are generally caused by a want of ventilation.

7. Because taxes will not (or ought not to) be so heavy, by reason of a less number of paupers, or poor being in the hospitals.

8. Because, if properly ventilated, your property is and will be from four to twelve per cent. benefitted by less repairs being required in consequence of the same.

9. Because the trouble of removing but one brick *to do so much good*, including the same to yourself, as before said, will, I am willing to believe, be sufficient inducement for your willingly urging ventilation to its fullest extent.

THE NIBLO'S GARDEN GAS EXPLOSION.

Whatever views may be held by us or by others, about the merits of the new enterprise of manufacturing and introducing oxygen gas for purposes of general illumination, it is not our intention to incur the imputation of unfairness or misrepresentation.

We therefore hasten to say that from information received from Dr. TORREY, who was employed as an Expert, to examine into the cause of the explosion, it appears that the latter was a consequence of culpable ignorance or negligence of the party who supplied the reservoirs into which the oxygen was compressed. It appears that these had been used repeatedly for the condensation of coal gas ! ! and there remained in them still a quantity of the volatile hydro-corbons condensed from the coal gas by the pressure, which of course were taken up again in vapor by the oxygen, forming a terrible explosive mixture.

H. W.

PROFITABLE PATENT.

We understand that Mr. J. W. Graham has already disposed of teritory, for the sale of his patent gas lamp post, to the amount of $15.000. We are glad to notice that this really deserving invention is meeting with such ready favor at the hands of the public.—*Scioto Gazette July* 28.

[We are happy to congratulate the lucky inventor Mr. J. W. Graham of Chillicothe, Ohio, referred to above, with great satisfaction, because the United States Patent for this Improved Lamp Post, was recently secured by our Patent Agency, and is now being secured in Europe for the Inventor. We foretold that it would prove to be a practical and financial success.—EDS. AMERICAN GAS LIGHT JOURNAL']

INSPECTION OF GAS.—In the present issue will be found the official report of Professor W. E. Aiken, showing the average of the observations on the illuminating power, purity, and pressure of the gas supplied by the Baltimore Gas Light Company. It will be seen that during the last quarter the gas has been above the standard both in illuminating power and purity, ranging in one week from 15 to 17 candles. We may also mention that the coal used at these works are exclusively from the Newburgh mines.

REPORT OF THE PORTLAND GAS LIGHT COMPANY.—We take pleasure in printing the annual report of this company, which we trust will be read with interest by the gas fraternity, showing as it does the prosperous condition of the company. The great feature in the report, is the introduction of an improvement for the manufacture of gas, lately patented by Mr. G. A. McIlhenney, Superintendent of Gas Works, Washington D. C., called the "Vacuum Process," which has the effect of keeping the gas pressure in the retorts at a minumum, by regulating the dip or hydraulic seal of the dip-pipes, thereby increasing the quantity, improving the quality, and preventing the formation of carbon, which latter goes to enrich the gas, instead of accumulating in a solid form in the retorts as formerly. By this process it will be seen, on refering to the report, that the yield of gas was increased from less than four feet and three-tenths per pound of coal, to upwards of four feet and seven-tenths per pound, and of improved quality.

THE TERRE HAUTE GAS LIGHT COMPANY, of Ind., declared a dividend of 5 per cent. on the 5th ultimo. This company is prospering under the astute management of the Superintendent, George Rugan. This gentleman often contributes valuable and acceptable matter to this Journal under the initial "R." May his candle power never diminish. In other words, may his shadow never grow less.

FRYER'S PNEUMATIC PUMP.—Attention is called to the illustrations on first page of Fryer's Pneumatic Pump, which the inventor has, after years of labor, succeeded in overcoming the difficulties attending the construction of a perfect apparatus for the compression of air and gases, and now place it before the public. At a public exhibition, a few days since, at the Oxygen Gas Works, on Forty-first street, near Eleventh avenue, where one of these pumps is used, a pressure of 220 pounds to the inch was obtained. Parties requiring such an apparatus should call on the enterprising inventor at 266 Broadway, N. Y. City, who will give them further information, as he claims it to be the best now in use.

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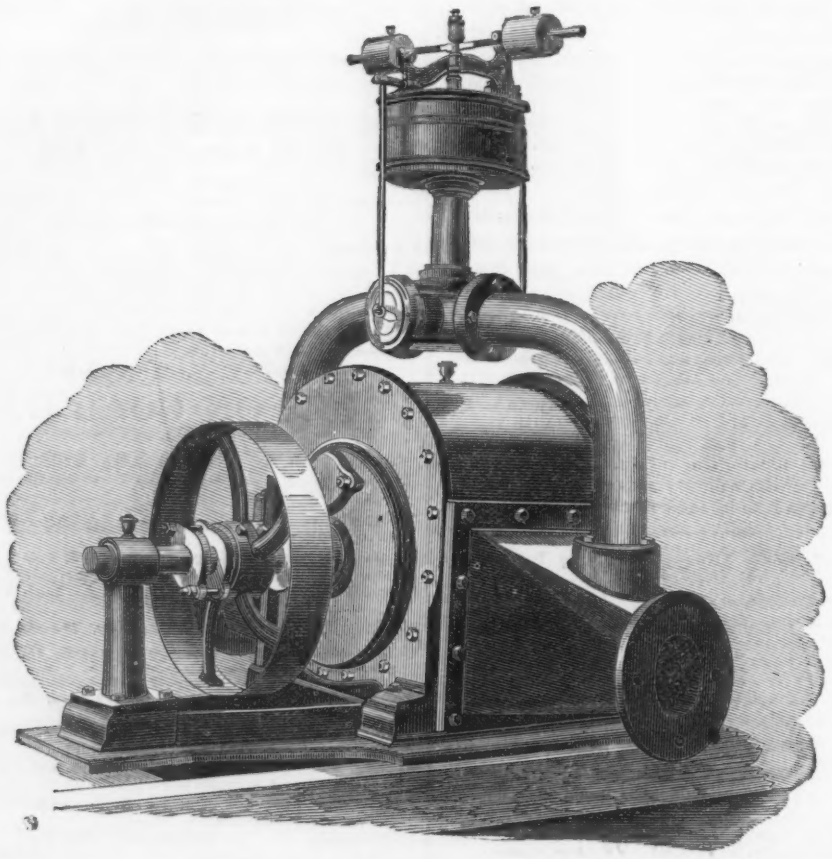

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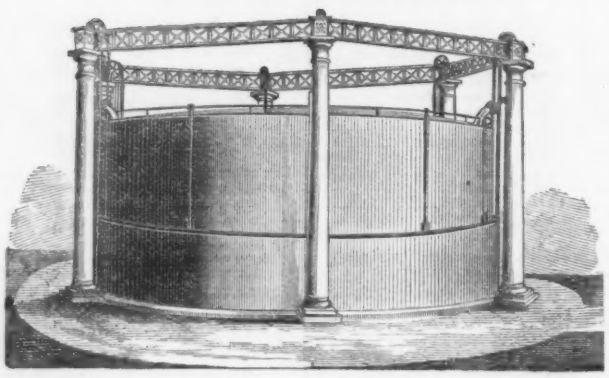

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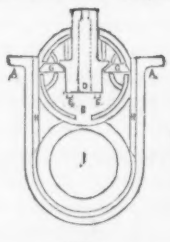

FIG. 3. FIG. 2.

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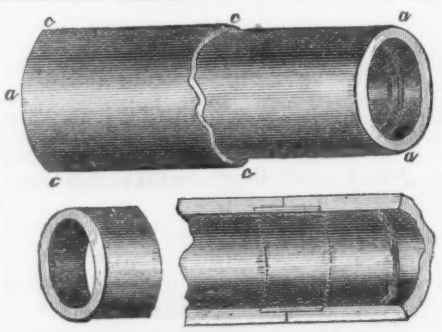

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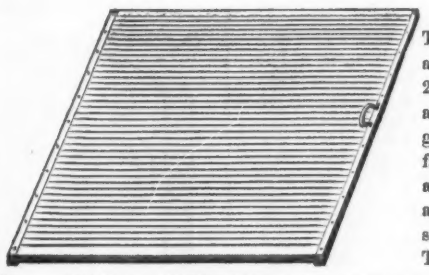

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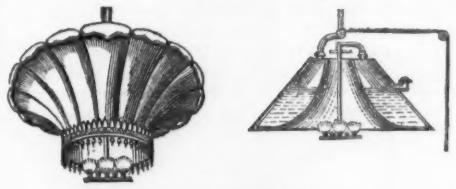

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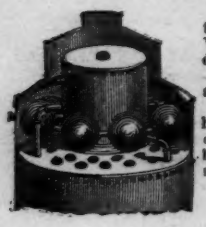

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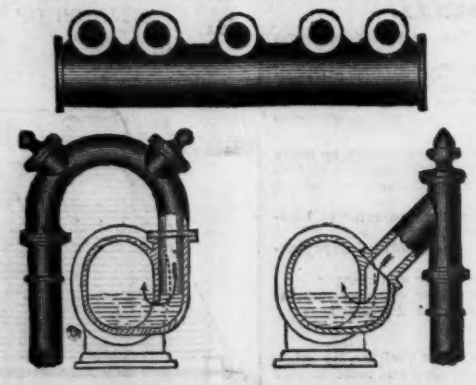

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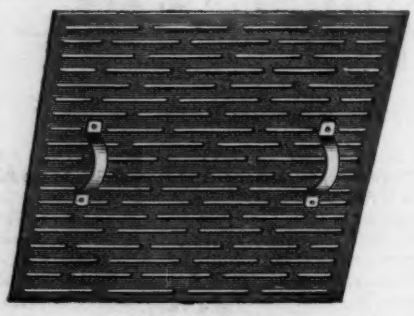

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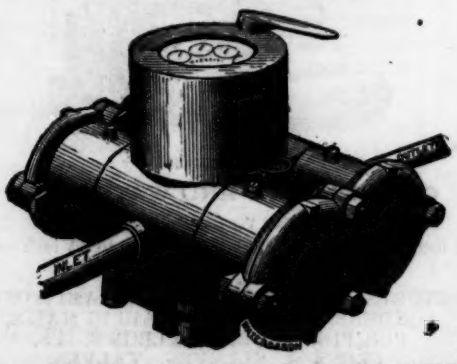

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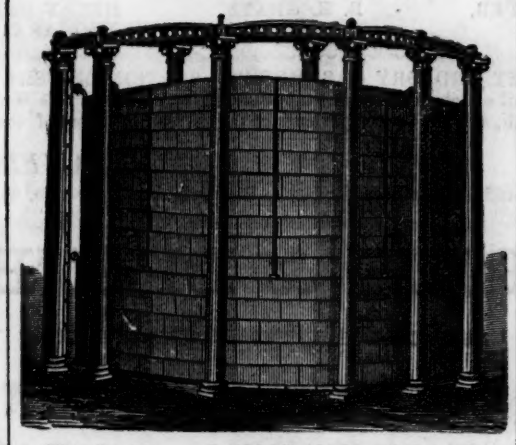

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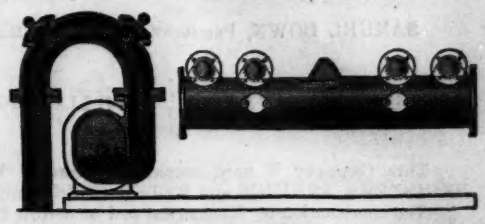

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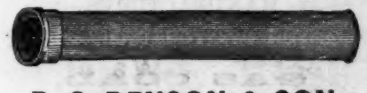

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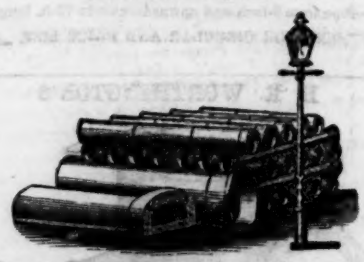

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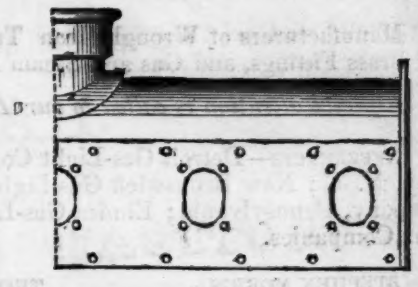

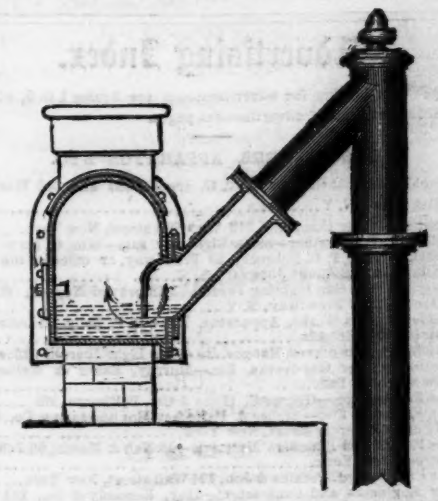

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